

**Notice of Allowability**

Application No.

09/591,781

Examiner

Heather R Long

Applicant(s)

KANG, SING BING

Art Unit

2615

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed on 7/12/2004.
2. ☒ The allowed claim(s) is/are 1-23.
3. ☒ The drawings filed on 6/12/2000 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All    b) ☐ Some\*    c) ☐ None    of the:
  1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  6. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_\_
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Allowable Subject Matter*

1. Claims 1-23 are allowed.
2. The following is an examiner's statement of reasons for allowance: Prior art fails to teach or fairly suggest a method of self-calibrating an omni-directional camera having a reflecting surface and a lens, in combination with all the other elements claim, comprising:
  - a. Tracking a feature across a sequence of omni-directional images; defining an objective function as an error between an actual feature location and a predicted feature location; and extracting a set of calibration parameters for the omni-directional camera by optimizing the objective function (claim 1).
  - b. Tracking features within the scene across a sequence of omni-directional images; characterizing epipolar geometry based on an initial set of calibration parameters; defining an objective function as a deviation from the epipolar geometry for the tracked features; and minimizing the objective function to obtain calibration parameters (claim 12).
  - c. Tracking features across an image sequence captured by the catadioptric camera system; identifying pairwise correspondence between the tracked features; defining an objective function in terms of an error metric based deviation from epipolar geometry for the pairwise tracked features; minimizing the error metric to minimize the objective function;

and extracting the optimal calibration parameters from the minimized objective function (claim 18).

d. Tracking point features across the sequence of omni-directional images; identifying pairwise correspondences between point features in an image pair that is two different images from the sequence of omni-directional images; defining an objective function as an error metric defined in terms of a deviation of the pairwise correspondences from epipolar geometry of the sequence of omni-directional images; minimizing the objective function using an optimization technique; and finding an optimal set of calibration parameters for the catadioptric camera from the minimized objective function (claim 20).

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Gullichsen et al. (U.S. Patent 6,346,967) discloses a method and apparatus for transforming a plurality of viewing vectors within a selected portion of the wide angle, three dimensional video input into two dimensional control points and uses a comparatively simple method to

Art Unit: 2615

transform the image between the control points to create a perspective-corrected field of view. This reference differs from the present invention in that it does not use a sequence of images to track a feature to obtain an objective function in order to extract a set of calibration perimeters.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather R Long whose telephone number is 703-305-0681. The examiner can normally be reached on Mon. - Thurs.: 7:00 am - 4:30 pm, and every other Fri.: 7:00 am - 3:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Christensen can be reached on (703) 308-9644. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



TUAN HO  
PRIMARY EXAMINER

Heather R Long  
Examiner

Art Unit: 2615

Art Unit 2615

HRL

November 12, 2004